Quantitative evaluation of AI denoising on abdominal CT imaging with small hepatic cysts and lesions: noise and contrast-to-noise performance

2026 JULY 19–22 VANCOUVER, BC
JOINT AAPM | COMP MEETING

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ABSTRACT

Purpose:
To evaluate the performance of a commercial deep-learning denoising algorithm (ClariCT.AI) for noise reduction and contrast-to-noise ratio (CNR) improvement in abdominal CT images with small hepatic cysts and lesions.

Results:
In the phantom study, ClariCT.AI substantially reduced noise magnitude compared with FBP (42%) and vendor IR (28%). Modest alterations in noise texture were observed for FBP+AI, with mean spatial frequencies shifts of 16% and 6% relative to FBP and IR, respectively. In clinical images, ClariCT.AI demonstrated consistent improvements in noise reduction and CNR across all cases. Mean image noise decreased from 16.2±3.1HU (FBP) and 14.6±3.2HU (IR) to 8.9±3.1HU (FBP+AI), with no apparent relationship to patient dose. Mean CNR increased from 5.4±2.1 (FBP) and 5.8±2.0 (IR) to 10.6±5.1 (FBP+AI).

Conclusion:
ClariCT.AI achieves substantial and consistent noise reduction and CNR improvement, indicating potential benefits for abdominal CT image quality and lesion conspicuity.

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I. INTRODUCTION

This study evaluated a vendor-neutral AI denoising algorithm (ClariCT.AI*) for abdominal CT using combined phantom-based analyses (noise power spectrum and contrast-dependent modulation transfer function) and patient-based validation, focusing on noise reduction and improved detectability of small hepatic cysts and lesions.

(*ClariPI, claripi.com, Seoul, Republic of Korea)

II. MATERIALS AND METHODS

Parameter	ACR CT Phantom	Clinical Images
Study Design Comparison		
Radiation Doses	50%-150% of the routine dose level (CTDIvol: 12 mGy)	Routine abdomen-pelvis protocol (AEC on; CTDIvol: 7.4-26.1 mGy)
Image Recon & Processing	FBP, IR, and FBP+ClariCT.AI	FBP, IR, and FBP+ClariCT.AI
Analysis	CTPro (www.ctpro.net)	Radiologist (10 cases)
Evaluation Metrics	• Noise magnitude and Noise Power Spectrum (NPS); • Contrast-dependent modulation transfer function (MTFc)	• Noise magnitude on subcutaneous fat; • Lesion contrast: • Hepatic lesion *vs.* adjacent liver parenchyma
Scanner & Acquisition Parameters		
CT Scanner	GE Revolution EVO CT scanner (GE HealthCare, Chicago, IL)	
Protocol	Routine abdomen-pelvis clinical protocol	
Tube voltage	120 kVp	
Automatic exposure control	Engaged for clinical cases	
Reconstruction kernel	Standard abdominal reconstruction kernel	
Slice thickness	5 mm	

III. RESULTS

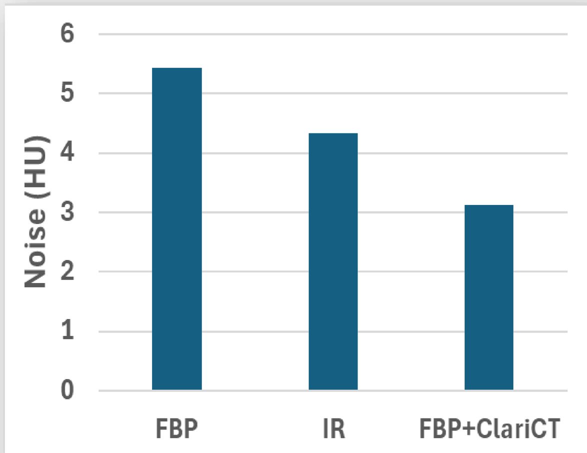

Fig. 1. Noise reduction in FBP, IR, and FBP+ClariCT in the phantom study.

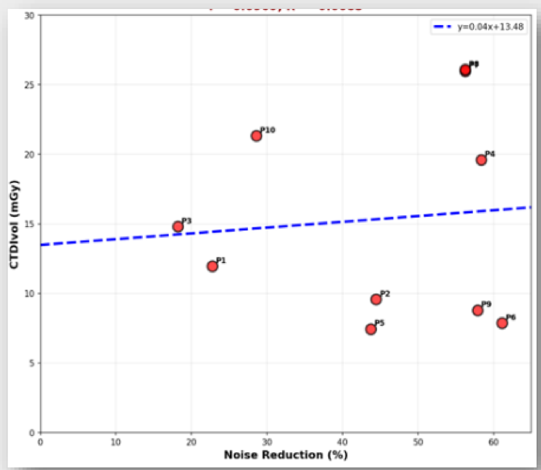

Fig. 2. Denoising of Clari.CT is independent of radiation dose level, working consistently across different dose levels.

III. RESULTS (cont.d)

Noise Power Spectrum & MTFc in ACR CT Phantom Images

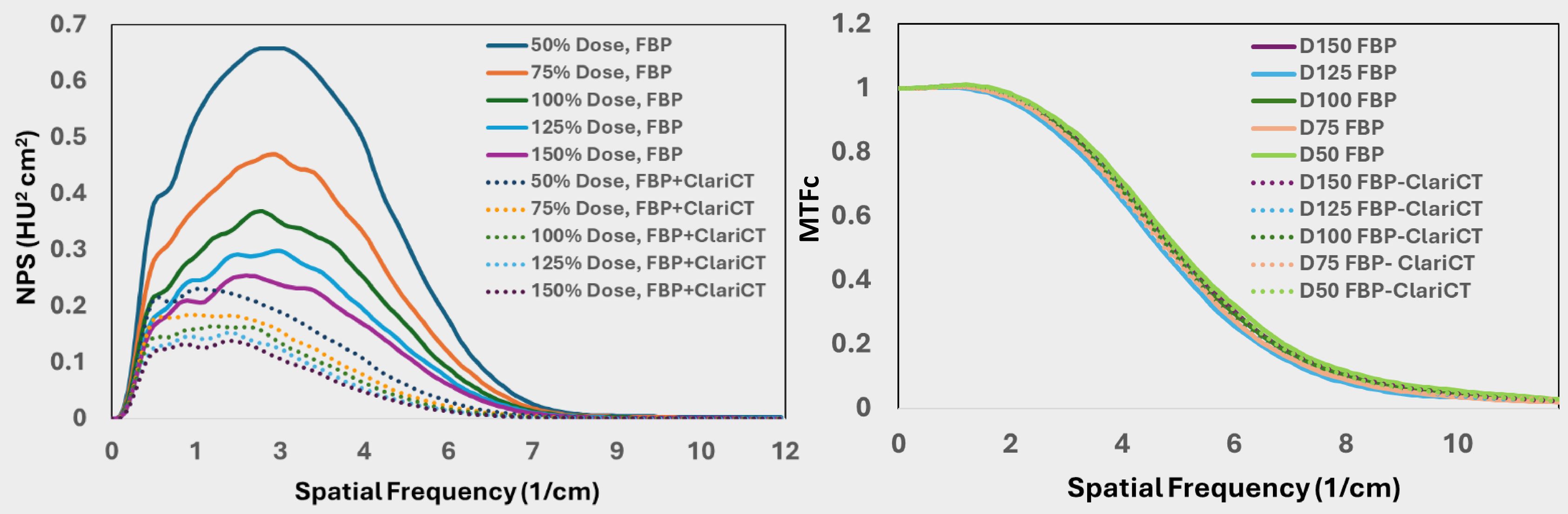

Fig. 3. (a) ClariCT.AI substantially reduced noise magnitude (area under the NPS curve) across all dose levels compared to FBP. Noise texture (the shape of NPS curve as a function of spatial frequency) was altered relative to FBP but more resembled that of IR. (b) The MTFc curves of FBP and FBP+ClariCT.AI were almost identical, meaning ClariCT.AI has capability in preserving fine details of structures as well as providing a finer image texture after denoise processing.
Results of IR and IR+ClariCT showed similar trends to those of FBP.

Noise Level and CNR in Clinical Images

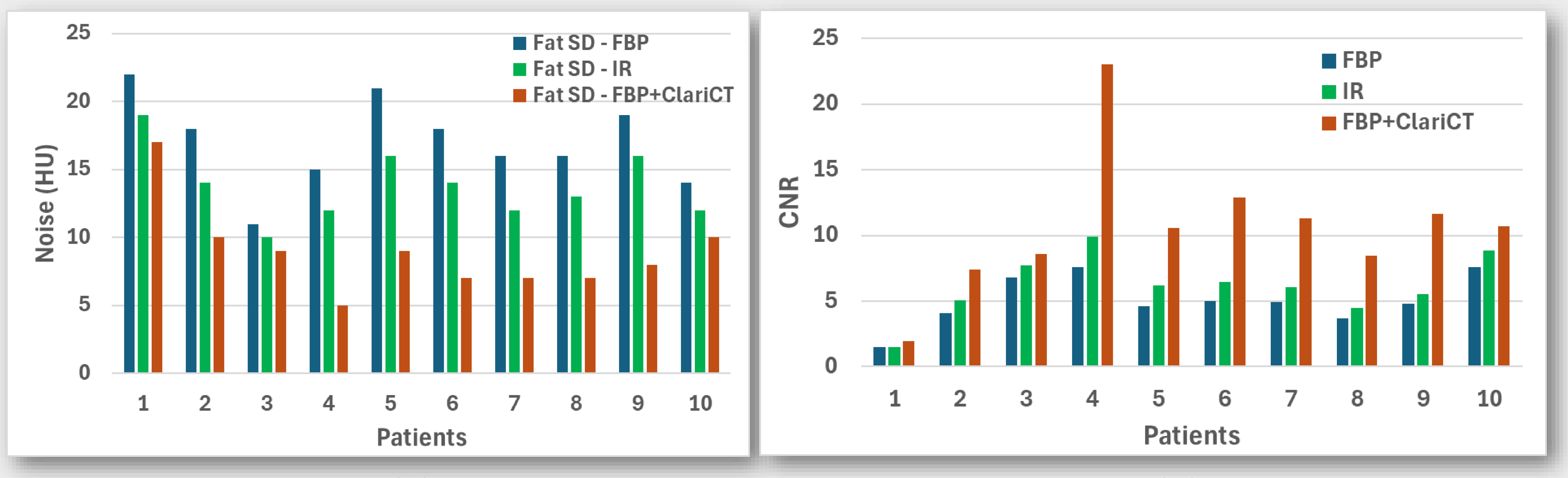

Fig. 4. Comparison of noise level among FBP, IR, and FBP+ClariCT in ten clinical cases. ClariCT.AI demonstrated consistent improvements both in (a) noise reduction and (b) CNR across all cases

Representative Clinical Images

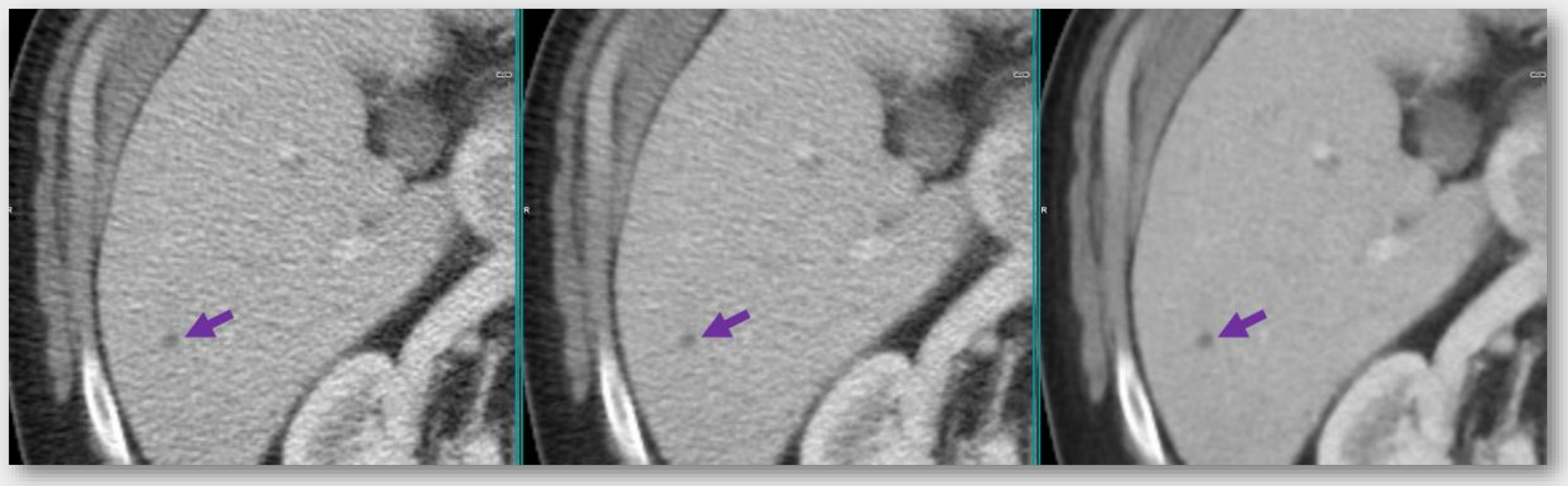

Fig. 5. The lesion (purple arrows) exhibits clearer boundaries on (c) ClariCT.AI–processed images compared with (a) FBP and (b) IR reconstructions.

IV. CONCLUSIONS

- **ClariCT.AI achieved noise reduction superior to vendor iterative reconstruction while preserving spatial resolution and maintaining low-contrast detectability.**
- **The patient example showed markedly improved delineation of boundaries and reduced image noise on ClariCT.AI–processed images.**
- **This study validates a commercial AI denoising algorithm (ClariCT.AI) for abdominal CT using combined phantom-based NPS analysis and clinical evaluation of noise reduction and CNR-based detectability in small hepatic lesions, demonstrating vendor-neutral, dose-independent performance relative to FBP and IR.**

REFERENCES

- Hong, et al., Incremental Image Noise Reduction in Coronary CT Angiography Using a Deep Learning-Based Technique with Iterative Reconstruction. *Korean J of Radiology*, 2020.
- Dehdab, et al., Evaluation of a Deep Learning Denoising Algorithm for Dose Reduction in Whole-Body Photon-Counting CT Imaging: A Cadaveric Study. *Academic Radiology*, 2025.
- Sadia, et al., CT image denoising methods for image quality improvement and radiation dose reduction. *J of Applied Clinical Medical Physics*, 2023.